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ABSTRACT

Acknowledging the need for additional practical resources for integrating technology into physical education assessment, this paper provides strategies and step-by-step instructions for incorporating Microsoft Excel into physical educators' assessment tools. The first section briefly reviews the literature on assessment in physical education. The second section describes data entry and beginning analyses, including entering student names, tallying points, and obtaining a mean and standard deviation. The third section covers advanced analyses based on hypothetical data generated for 20 5th grade male students' performance in the Presidential Physical Fitness test shuttle run. The fourth section discusses data presentation basics, including creating charts and graphs. Sample charts and graphs are appended. (Contains 14 references.) (MES)

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Tips for Using Microsoft® Excel in Assessment

David Kahan

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Tips for Using Microsoft® Excel in Assessment

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Tips for Using Microsoft® Excel in Assessment

According to Siedentop and Tannehill (2000), assessment refers "to a variety of tasks and settings where students are given opportunities to demonstrate their knowledge, skill, understanding, and application of content" (pp. 178-179). At the secondary level, assessment is often viewed negatively, as impractical and unimportant, and hindering student activity and enjoyment (Matanin & Tannehill, 1994). Teachers cite lack of time, inadequate teaching environments (e.g., insufficient equipment, inadequate facilities, too many students, discipline problems), lack of administrative support/accountability, lack of testing knowledge/practice, and concerns over upsetting the collegial status quo as reasons for minimizing assessment (Lund, 1993; Veal, 1990). Despite these problems, physical educators have many resources to choose from for understanding assessment theory (e.g., Morrow Jr., Jackson, Disch, & Mood, 1995) and practice (e.g., Kleinman, 1997; Schiemer, 1999).

For the elementary school level practitioner, in particular, many resources for understanding, implementing, and summarizing/reporting assessment standards and options exist (e.g., COPEC, 2000; Graham, Holt/Hale, & Parker, 2001; Holt/Hale, 1999; Lambert, 1999; Pangrazi, 1998; Schiemer, 2000). In addition to such resources, practitioners would benefit from user-friendly, how-to information that demonstrates technologies available for assessment data entry/storage, analysis, and presentation. For example, Mohnsen & Mauch (1998) presented uses for handheld and palm computers in assessment. Acknowledging the need for additional practical resources for integrating technology into physical education assessment, this article provides various strategies and

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step-by-step instructions for incorporating Microsoft Excel® into physical educators' regular assessment arsenal.

Data entry and beginning analyses

Most personal and office computers come with Microsoft Office packages, which include Microsoft Excel®. Excel is essentially a matrix of rows and columns; you input data and then select the formula you need for analysis and the means of display (e.g., spreadsheet, graph, chart). By clicking on the Excel icon, a new and blank spreadsheet will pop up on the screen. Letters and numbers designate columns and rows, respectively. To highlight an entire column or row, simply click on a particular letter or number, respectively. To highlight an individual or multiple cells, click on an individual cell or click and drag over the desired cells, respectively.

You can use Column A as the *student name* column and input student's names or ID numbers down the column. Then input names of each assessment (e.g., exam 1, journal, portfolio), beginning in cell B1 (column B, row 1) and going across. Reserve the last three columns for total points, percentage, and grade. Next, enter scores as they become available into the appropriate cells. (To move cell-to-cell across a row, hit <tab>; to move cell-to-cell down a column, hit <enter>.)

At the end of a marking period, you can take several shortcuts in tallying up points. For *total points*, go to the first student's *total points* cell and hit <Σ> on the toolbar. (Doing this tells Excel to add all of the cells across a given row giving a sum. Copy this function by hitting the <Ctrl> and letter <C> keys simultaneously, then paste [<Ctrl> and letter <V> keys simultaneously] down the entire *total points* column. Totals for each student will result.) For determining *percentage*, return to the first student; this

time go to the cell to the right of *total points* and type in the name of the *total points* cell (e.g., H2, I2, J2) followed by </# total points possible>. For example, the first student's *percentage* cell might look like <J2/150>. As before, copy and paste this formula down the entire column and percentages will be calculated for each student. For the *grades* column, simply type in the letter grade equivalent for the given percentage to its left.

To obtain a mean (average) and standard deviation (variance in scores) for an assessment, go down to the empty cell under a given column's last cell entry. For the mean, type < =*AVERAGE(*array*)*>, and for standard deviation, in a separate cell type <=*STDEV(*array*)*>. (An *array* is the range of data cells; for example C1:C20 would be a column of 20 cells reflecting an assessment of 20 students on some measure.)

The Excel file you work on has the capacity for storing data for all of your classes, by either recording multiple classes on a single worksheet or using new worksheets (bottom left: Sheet 1, Sheet 2, Sheet 3 options) for individual classes. A sheet can be set up for neat and efficient printing by doing two quick tasks: First, click on <File> in the upper-left corner, scroll down to <Page Setup>, click on <Page>, click the bullet for <Fit to> (which will compress all your data down to a single page). Second, under <Page Setup>, click on <Sheet>, and click the box <Print Gridlines> (which will print gridlines separating rows and columns).

Advanced analyses

In the previous section, basic descriptive statistical analyses techniques of assessment data were presented. Excel has a great deal more analytic capacity for physical educators to tap into for more advanced data analysis.

The following discussion is based on hypothetical data generated for 20 5th-grade male students' performance in the Presidential Physical Fitness test shuttle run (Figure 1). The shuttle run is a measure of speed and agility–components of skill-related fitness required of many sports and games–and one where criterion- or norm-referenced standards may not categorize student performance at particular schools. The names of 20 male students are listed vertically down Column A and their shuttle run times down Column B. Before beginning most fitness test analyses, the tested group's scores must be sorted and separated according to age and gender. In this case, boys' and girls' scores are separated, since after age 11, speed is differentially distributed by gender (Haywood, 1993) and award qualifying standards on the Presidential Physical Fitness test for the shuttle run are differentiated for 10-year-olds by gender by 0.5 seconds. Additionally, all boys in this sample are the same age as speed generally increases with age in boys throughout adolescence making comparisons across ages inappropriate (Haywood, 1993)[1].

The first step in any analysis is to determine whether the scores of those tested are normally distributed–the classic bell-shaped curve. In most instances, physical educators can assume that fitness test scores are normally distributed owing to the many children typically tested and their fitness heterogeneity. If test scores are not normally distributed, test results over many years–generated by hundreds to thousands of students–can be collected, retained, and entered into the database in order to develop criterion-referenced standards, or test results for multiple classes can be compiled and entered into the

[1] As speed plateaus in girls after age 12, comparing performances across ages is not problematic; therefore scores across ages for girls may be combined for analysis.

database for analysis across classes (e.g., elementary school physical educators who test 2-3 classes of a given grade at a time).

In this example, the mean score is found in cell B22 and is equal to 11.12 seconds. That is to say that the 20 students averaged slightly over 11 seconds for the shuttle run. In this example, the standard deviation value is found in cell B23 and is equal to 1.14 seconds. In most groups, all scores are captured within +/- 3 standard deviations. In this example, all 20 students' scores are within +/- 3 standard deviations of the mean. Physical educators can identify exceptional students who score either quite high or low in comparison to the group by identifying those students whose scores fall above or below +/- 1.3 standard deviations (roughly the upper and lower 10%).

Column C, labeled Percentiles, is the easiest-to-understand way of comparing a student's score to his peers. A percentile tells you the percentage of scores a particular student's score is higher than. For example, Carlos' percentile of .893 says that his dash time is better than almost 90% or 18 of his classmates. If you look back at the dash times, you can see that what the percentile value tells us about Mike's standing is very accurate–Adam equaled his time. Using Excel, the following steps were used to calculate the percentiles seen in Figure 1: (a) go to the first empty cell after having entered in students' names and raw scores (in this case, that would be cell C2); (b) type the following formula[2]< *=(1-NORMDIST(B2,$B$22,$B$23,TRUE))*>; and (c) after having

[2] The formula begins with <1 – >, which must be included when evaluating any test in which a lower score is preferable to a higher score, e.g. dashes, mile runs, reaction time, agility runs, golf scores. When evaluating tests, in which higher scores are preferable, begin the formula with "normdist." The dollar signs ($) in the formula tell the computer to hold those cells constant when performing the calculation–in other words to use the mean and standard deviation found in cells B22 and B23 for all percentile calculations. This technique will be used repeatedly in all further calculations. Its main purpose is to save time.

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entered it, copy and paste it down the entire column so as to avoid retyping the same formula for each student.

While some physical educators prefer using norms to compare students' scores to each other or a national population (especially in fitness test situations), identification of a minimum, passing criterion for satisfactory achievement levels may be more preferable so as to discourage students from comparing their performance to others. The driver's license exam is one of the most recognizable criterion-referenced tests. In most states, scoring a 70 or better indicates satisfactory knowledge of traffic rules and regulations. With fitness testing, Excel can be used to identify minimum competency levels of skill- and health-related fitness based on the context of individual schools and physical educators' goals. It is best to utilize as many scores as possible when identifying criteria. Ideally, scores from many students collected over many years can inform the criterion identification process. For the sake of this tutorial, I went ahead and calculated criteria in order for the reader to visualize and understand the process, however using only 20 students to set criteria is inadvisable. Cell D23 shows a time of 10.52 corresponding to the 70th percentile. Thus any student who runs faster than roughly 10.5 seconds may be considered to possess satisfactory speed/agility. Values for the 80th and 90th percentiles appear in cells D24 and D25 respectively. Once criteria are established, they can be presented to challenge new crops of students or be used to letter grade students' performances (e.g., a time corresponding to the 90th percentile or above earns an 'A'). For calculating the scores associated with each of the three criteria, these steps were

followed: (a) go to any empty cell; and (b) type in the formula[3] <=*NORMINV(*specified criterion,*B22:B23)*>.

Data presentation basics

One task in the assessment process is the translation and communication of scores to administrators, students, and parents in ways that provide feedback and motivation. Visual displays of data are particularly effective for doing this and Excel offers many options for graphing and charting data.

On the toolbar, a bar-graph-looking icon, called *Chart Wizard* appears. When you click on this icon, after having highlighted the data and column titles you wish to display, Excel will ask what chart type you want, offering *standard type* as a default. Under standard type, there are various options; two of the easiest to master and also visually effective are the pie chart and line graph. Under each type are sub-types to choose from; the *Chart Wizard* offers a default option.

The *Chart* Wizard helps you create charts using a four-step process. The following step-by-step instructions for creating an exploded pie chart are based on the single row of data (i.e., for a single student) and resulting chart depicted in Figure 2. The spreadsheet is first set up with the assessment names and points possible values in parentheses (row 1) and the scores for these assessments (columns B-F). A total points column also appears but is not used in charting. Use the mouse to highlight row 1 and the student data row. Under the *exploded pie* chart subtype, you can click on <*Press and Hold to View Sample*> to see what the chart will look like before continuing. If satisfied

[3] The specified criterion may be .7 (70th percentile), .8 (80th percentile), and so on. Note that when constructing cut-offs for a test, in which a lower score is preferable to a higher score, you must enter in a number corresponding to (1 – specified criterion). In the 50-yard dash for example, instead of entering .7, .8, and .9 for 70th, 80th, and 90th percentiles, you would enter .3, .2., and .1, respectively.

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with the general appearance, click the <*Next*> box. In step 2, a *Data Range* and *Series* tabs are presented. Under the *Series* tab, you can title a chart by typing words where you see *Name* sub-tab. The *Series* tab offers a *Values* sub-tab, which is used if the spreadsheet contains multiple students and you wish to produce charts for each. Simply enter the cell range for a particular student. For example, if a second student appeared under Hector in row 3, at the *Values* sub-tab, you would type in <*Sheet1!$B$3:$F$3*>. This command tells Excel to isolate row 3 for a new chart and not include Hector's data. In step 3, *Titles*, *Legend*, and *Data Labels* tabs are provided. Key options in this step are: (a) under *Legend*, you can select where to place the legend, and (b) under *Data Labels*, you can select whether to show the value (raw assessment scores), percent (percentage contribution of each assessment to the total), and label and percent (shows the percent and the name of the assessment next to each pie slice for easier identification). You may also want to tick off *Legend key next to label*, which will provide a small colored box corresponding with the legend's category coloration. Finally, in step 4, you select where you wish to place the chart—as a new sheet or on the spreadsheet in use. Once you have finished, you can edit chart features by using combinations of right and left mouse clicks; of particular interest is using the mouse to make the chart area larger before printing.

Graphing assessment data can reveal performance patterns and trends over time. The following example is based on hypothetical data obtained during weeks leading up to a Jump Rope for Heart (JRFH) event (Figure 3). Suppose at the end of each lesson over four weeks prior to JRFH, students are given 10 minutes to accumulate as many jumps as they can for training purposes. They record their jumps in a personal journal and would

like to see how they are progressing after three weeks. Students can use Excel to graph their performance, which will provide visual feedback and foster goal setting.

There are four steps to creating graphs. First, after highlighting the data and column title, select the *line* chart type and under sub-type, select the middle row, far left option (*line with markers displayed at each data value*); it is the easiest to understand. Step 2 can be ignored in this example; it offers *data range* and *series* options that are beyond the scope of this tutorial. Step 3 offers the most options: *Titles*, *Axes*, *Gridlines*, *Legend*, *Data labels*, and *Data tables*. Under *Titles*, you can give the graph's axes labels; in this example, the x-axis is labeled *Day* and the y-axis is labeled *Jumps*. Under *Legend*, you should unclick *Show legend*. Under *Data labels*, you can select *show value* if the resulting values (in this example the actual number of daily jumps) do not clutter up the graph too much. Finally, step 4 offers placement options—the graph as a separate chart or on the spreadsheet in use. As in the pie chart example, you can alter the size of the graph using a combination of right and left mouse clicks. Additional data presentation options are available if you right-click the mouse on the data markers in the graph; of particular interest is adding a trend line and formatting the line and markers.

In Microsoft Excel®, physical educators have an ally that makes the assessment process faster and easier. With the Excel program, the formulae, and examples in this article as guides teachers or students can input, analyze, and present assessment data more efficiently and clearly.

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Figure 1. Sample spreadsheet, norm and reference scores for hypothetical shuttle run times.

	A	B	C	D
1	**Name**	**Shuttle (s)**	**Percentiles**	
2	Mike	10.3	0.764	
3	Pablo	11.5	0.369	
4	Felipe	12	0.220	
5	Juan	13.1	0.041	
6	David	10.1	0.814	
7	Raul	12.2	0.172	
8	Peter	9.9	0.858	
9	Jordan	10.5	0.707	
10	John	11.1	0.507	
11	Franklin	11.1	0.507	
12	Ben	11.7	0.306	
13	Ryan	12.2	0.172	
14	Quincy	13.2	0.034	
15	Adam	9.7	0.893	
16	Marco	12.2	0.172	
17	Omar	9.8	0.876	
18	Sanford	10.1	0.814	
19	Tremaine	10.2	0.790	
20	Carlos	9.7	0.893	
21	Hunter	11.8	0.276	
22	AVERAGE	11.12		
23	STDEV	1.14	70th Percent	10.52
24			80th Percent	10.16
25			90th Percent	9.66

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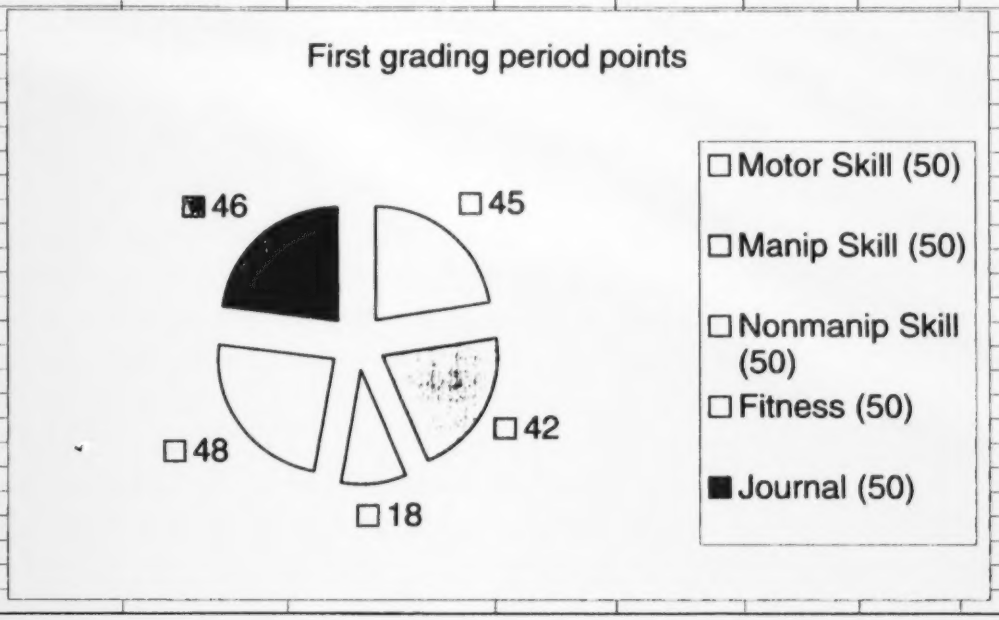
Figure 2. Student points (spreadsheet) and pie chart for hypothetical grading period.

Student	Motor Skill (50)	Manip Skill (50)	Nonmanip Skill (50)	Fitness (50)	Journal (50)	Total (250)
Hector	45	42	18	48	46	199



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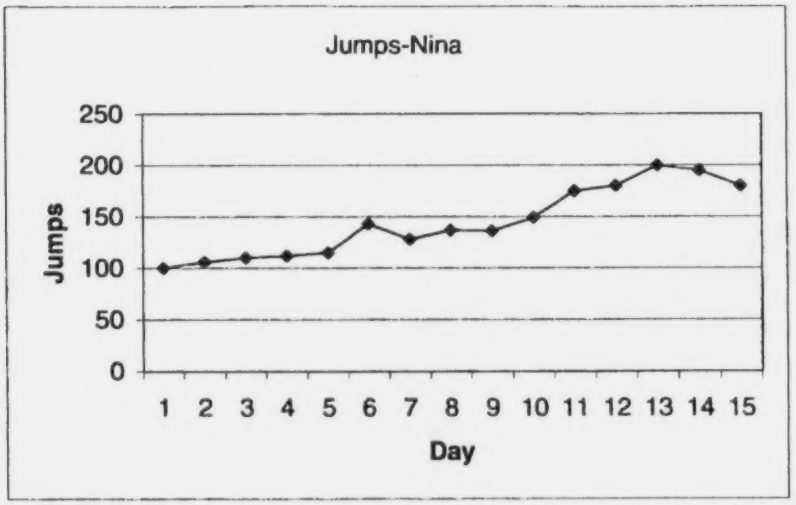

Figure 3. Example of spreadsheet and graphic display of hypothetical jump rope data.

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